4. DESCRIPTION OF THE DISTRICT

4.1 Climate

Rainfall

It is apparent that there are no official recording centres within the area of the Cleve hills that is known to receive greater than 400 mm annually. The annual rainfall 400 mm isohyets (Figure 2), and the April-October rainfall 300 mm isohyets (Figure 3) have been estimated from unofficial landholder rainfall data, together with local topography, which has a marked influence on rainfall within the April to October period.

The lowlands east of the Cleve hills experiences a ‘rain shadow’ effect, receiving comparatively low rainfalls from the westerly to south westerly weather systems (that are dominant) from April to October. Rainfall also decreases slightly from the south to the north of the Board District.

The effective ‘growing season’ rainfall from April to October (Table 2) of most centres is greater than 70% of the annual total; the highest being 77% at Wharminda, and the lowest at Pondooma, 66% of the annual total.

The amount of moisture that is available to a crop, however depends upon evaporation rates and soil moisture storage, as described in following sections.

Drought incidence

According to local opinion, serious droughts are considered to have occurred in the Board area in 9 seasons since 1945, namely 1945, 1957, 1959, 1967, 1977, 1982, 1988 and 1994, and 1999 in some areas. Since 1994 the Bureau of Meteorology has identified the following areas and seasons as being drought affected:

March 1994 to December 1994	Arno Bay, Mangalo, Pineside, Waddikee, Yabmana and Darke Peak
March 1994 to May 1995	Kimba
July 1994 to December 1994	Cowell and Wharminda
August 1994 to May 1995	Cleve
April 1997 to September 1997	Yabmana
June 1999 to January 2000	Darke Peak

Table 1 shows the mean rainfall received for 2-month periods within the ‘growing season’ in these years. Unless higher rainfalls are received, it is highly unlikely that adequate crop yields will be produced.

<u>Table 1: Mean rainfall recorded in April to September over 6 drought years</u>

OFFICIAL RECORDING CENTRE	MEAN RAINFALL RECORDED IN 2-MONTH PERIODS IN 6 "DROUGHT" YEARS (mm)		
	APRIL - MAY	**JUNE - JULY**	**AUG - SEPT**
Arno Bay	24	43	42
Buckleboo	23	48	40
Cleve	38	58	61
Cowell	19	28	38
Darke Peak	31	64	61
Kimba	22	52	50
Rudall	30	48	51

<u>Table 2: Mean Monthly and Annual Rainfall – All Years of Record at each Station (mm)</u>
Data from Autralian Bureau of Meteorology

RECORDING CENTRE	NO. OF YEARS	J	F	M	A	M	J	J	A	S	O	N	D	YEAR TOTAL	APRIL-OCT TOTAL	% OF YEAR TOTAL
Arno Bay	82	13	19	16	26	34	37	37	37	34	29	21	19	**321**	**234**	73
Buckleboo	53	20	21	15	20	31	31	35	36	32	27	24	18	**310**	**212**	68
Balumbah	23	14	16	14	29	44	44	44	43	36	22	18	21	**345**	**262**	76
Barna	15	14	19	10	15	20	27	29	37	22	24	19	12	**254**	**174**	69
Carpa	56	14	25	17	32	37	36	38	38	35	31	25	22	**350**	**247**	71
Cowell	104	14	19	18	27	30	28	26	27	28	28	20	16	**281**	**194**	69
Cleve	93	15	23	22	30	41	45	46	48	42	37	28	24	**400**	**289**	72
Darke Peak	75	14	22	15	25	42	48	49	52	43	33	23	21	**386**	**292**	76
Glynn	26	10	14	20	17	31	31	26	29	32	25	19	15	**269**	**191**	71
Kimba	69	16	21	16	23	37	38	42	42	36	30	23	18	**342**	**248**	73
Kielpa	58	13	21	16	27	38	42	49	47	38	31	22	21	**365**	**272**	75
Mangalo	83	15	21	17	27	36	37	39	42	37	30	24	18	**343**	**248**	72
Miltalie	56	15	25	16	28	32	34	29	32	32	31	21	15	**310**	**218**	70
Pineside	80	12	21	16	24	34	37	42	39	34	29	20	20	**328**	**239**	73
Pondooma	76	15	21	18	22	28	25	23	24	26	25	20	17	**264**	**173**	66
Rudall	64	12	19	16	26	37	37	45	42	35	29	23	21	**342**	**251**	73
Waddikee	62	13	18	10	24	35	38	43	43	35	29	23	18	**331**	**247**	75
Wharminda	76	12	14	15	22	37	41	47	47	40	28	18	21	**342**	**262**	77
Yabmana	51	15	25	18	34	39	37	40	40	37	32	26	23	**366**	**259**	71

Figure 2. Annual rainfall isohyets

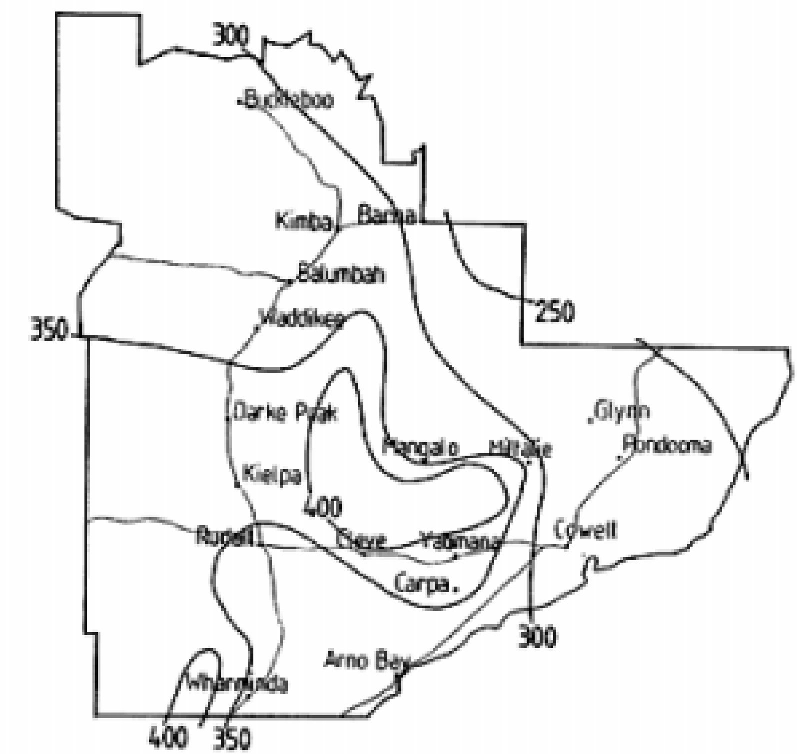
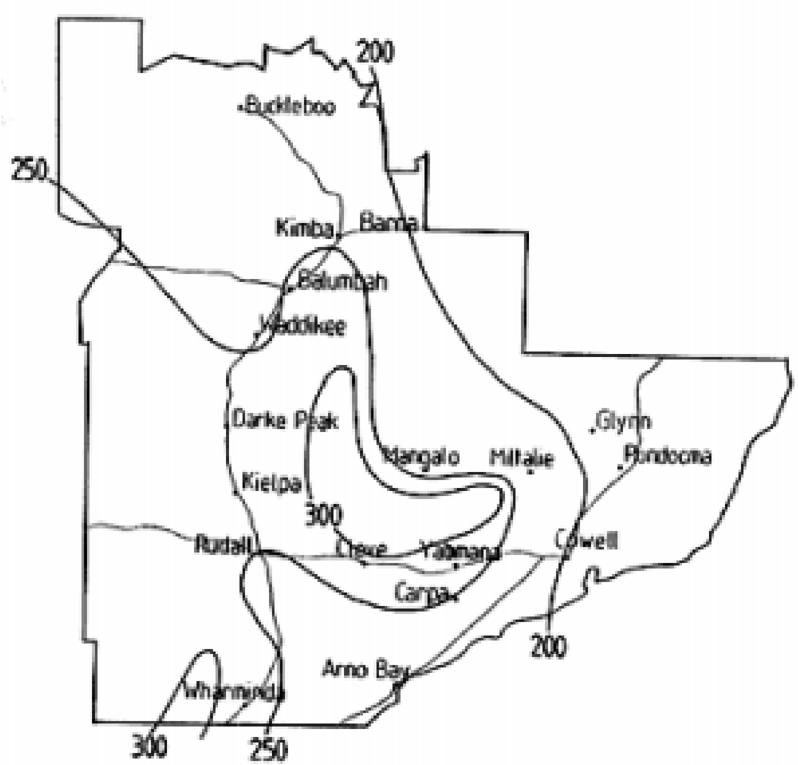


Figure 3. April - October rainfall isohyets



Data from Bureau of Meteorology, S.A.

Potential Evapotranspiration and Plant Growth

Potential evapotranspiration is an estimate of the amount of moisture lost by evaporation and transpiration from a fully vegetated area where soil moisture is not limiting to growth.

The length of the effective 'growing season' is also affected by the amount of moisture that is stored in the soil and which can become available for plant uptake.

Figures 4a and 4b show for Cleve and Kimba, respectively, the period of the year, on average, when rainfall exceeds the estimated potential evapotranspiration, which indicates the average length of time that unirrigated crop growth can occur.

At Kimba, a typical soil moisture storage capacity may be around 80 mm for a soil profile of 1 m depth, with a 'light sandy clay loam' texture over a clay subsoil. With this storage capacity, water may remain available for growth until about the last week in October, even though rainfall stopped exceeding potential evapotranspiration at around the third week in August (figure 4b).

In comparison, a shallower soil with a loamy-sand to sandy-loam texture might have a moisture storage capacity of only 40 mm. Given the rainfall and evapotranspiration data at Kimba, this soil profile would not store surplus moisture for plant growth after the third week in August.

The data at Cleve indicates a slightly longer average period of rainfall exceeding evapotranspiration, which, given the same soil moisture storage capacity as at Kimba, would enable higher potential crop yields to be achieved than at Kimba.

At drier locations such as Cowell, it is likely that the effective 'growing season' is shorter and lower average crop yields would be obtained than at Kimba or Cleve.

Nevertheless, there are many other physical factors that influence the potential yields of crops, such as the amounts of rainfall received at particular dates, and the length of time between rainfalls.

Temperatures of below 10^{o}C may also slow plant growth. Figures 4a and 4b show that mean daily temperatures at Cleve and Kimba are above 10^{o}C throughout the year. Temperatures may briefly fall below this at night but overall, temperature would not be expected to significantly limit plant growth in the District.

Frost incidence

Serious frosts that cause major economic damage to crops rarely occur in the Board area. Frosts do occur throughout the District in various years. For example, there have been only three years in the past 30 years that serious frost damage has been reported in crops, in 1968, 1986 and 1992.

Figure 4a. Monthly temperatures, rainfall and potential evapotranspiration: Cleve

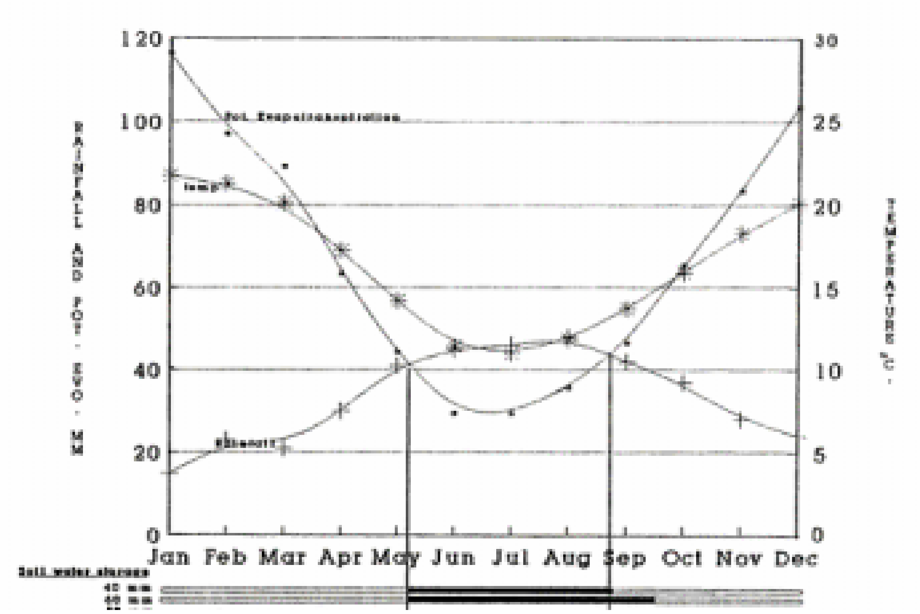
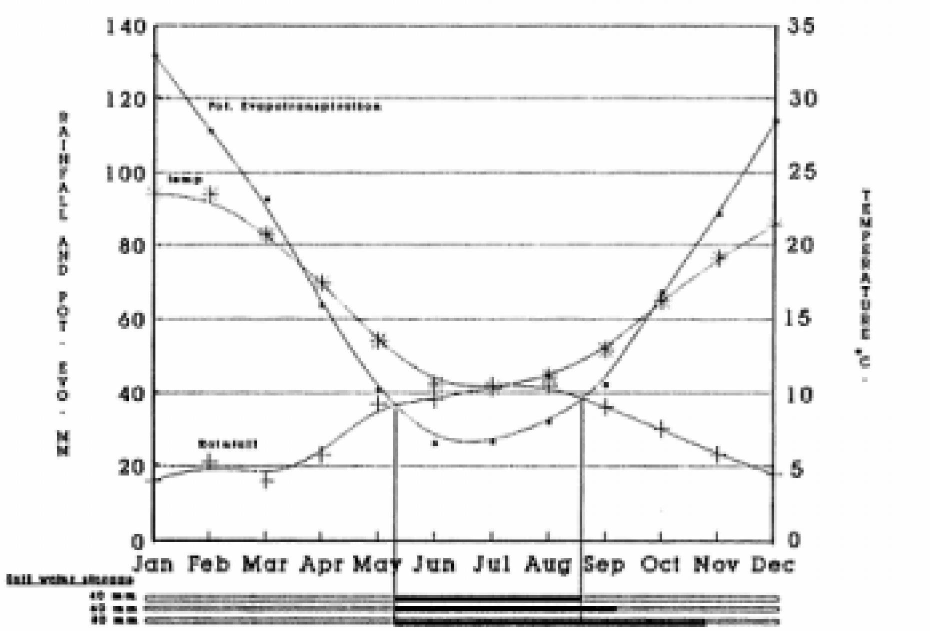


Figure 4b. Monthly temperatures, rainfall and potential evapotranspiration: Kimba



Data from Bureau of Meteorology, S.A.

Wind

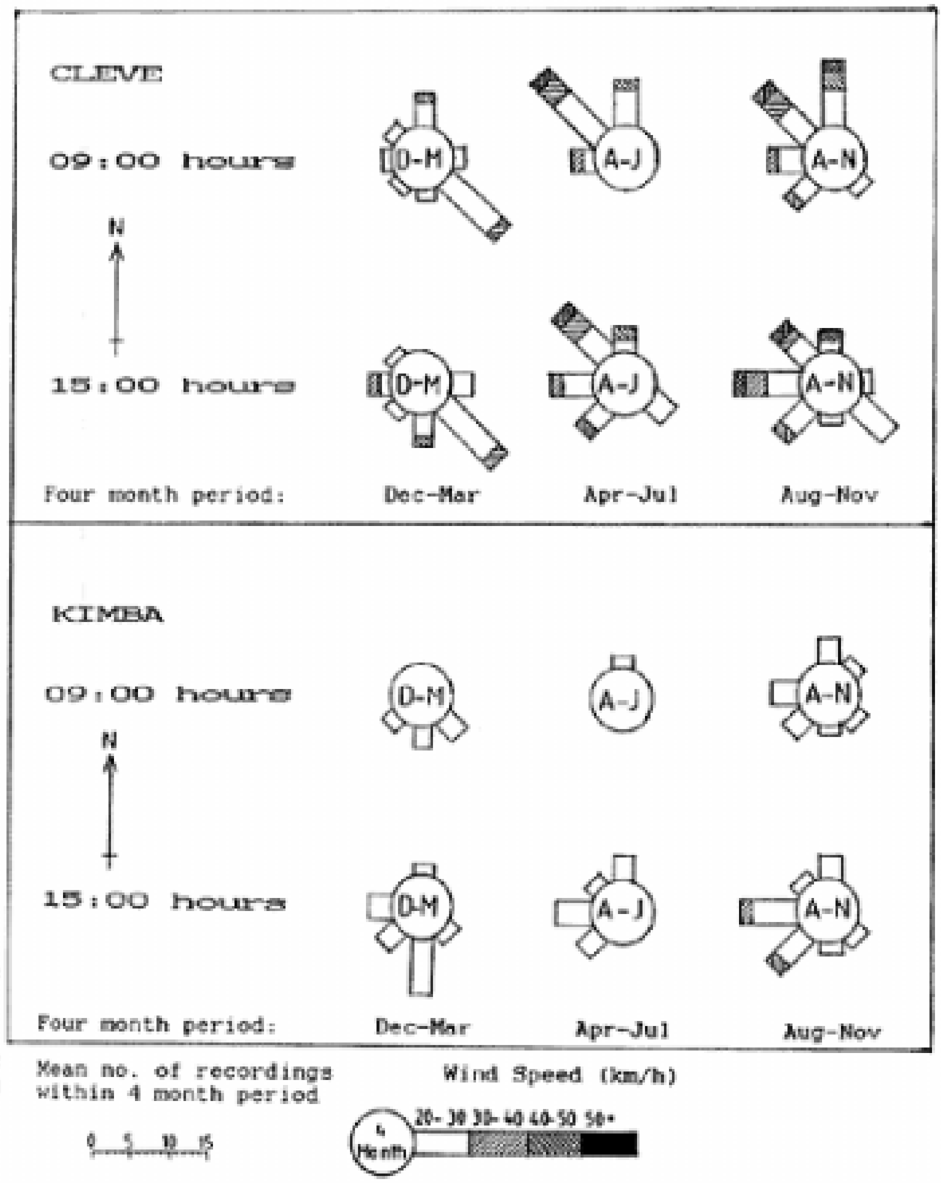
Official wind recording centres in the Board District are at Kimba and Cleve. Figure 5 shows the average number of times per month that potentially erosive winds, ie. greater than 20 km/h were recorded at 9 am and 3pm during 4-month periods at these centres.

At Kimba, prevailing winds during April to November occur from the west and south-west at speeds up to 30-40 km/hr. From December to March, however, prevailing winds occur from the south at speeds up to 20-30 km/hr.

At Cleve, prevailing winds during April to November occur from the west, north-west and north at speeds up to 40-50 km/hr. from December to March, prevailing winds from the south-west occur at speeds up to 30-40 km/hr.

Along the Eastern coast and Cowell flats, stronger winds are known to occur than at Cleve due to proximity to the sea, although there is no official recording centre in this area.

Figure 5. Incidence of potentially erosive winds at Cleve and Kimba



Data from Bureau of Meteorology, S.A.

4.2 Topography

The general topography of the Board District consists of a broad area of ranges north of Cleve flanked by undulating land that is overlain by sand ridges in many areas.

The Cleve-Cowell hills consist of moderately to steeply sloping land of around 300 to 400 m in elevation, with a few peaks exceeding 450 m such as Carpie Puntha Hill (481 m) and Mount Olinthus (455 m).

Some isolated peaks that occur west of the Cleve hills are Darke Peak (450 m) and the granite outcrops of Carappee Hill (495 m) and Caralue Bluff (486 m).

The Kimba area consists of gently rolling topography up to about 300 m elevation.

Much of the western area of the Board District, and the area north-east of Cowell, is predominantly flat to gently sloping land overlain with parallel sand ridges that lie in a north-west to south-east direction. These ridges are typically up to about 5 m in height and often extend to several kilometres in length.

4.3 Geology and Geomorphology

The geology of land in the Board area (Figure 6) generally falls into three groups:

(1) Plains and sand ridges consisting of Quaternary age (up to 1 million years old) deposits that cover the remainder of the Board district, consisting of :

- jumbled dunes of siliceous (quartz) sand, called ‘Lowan’, and calcareous (marine) sands, called ‘Haslam’;
- the parallel dunes of siliceous sand, called ‘Moornaba’ that are orientated in a north-west to south-east direction;
- sand spreads amongst the northern and eastern Cleve hills near Miltalie, which could be the result of redistribution of sediments.
- Limestone formations; during the Quaternary period, there has been percolation of calcium carbonates into the soil in much of the district. At varying stages, cemented carbonate layers formed such as the very hard ‘Ripon’ and ‘Bakara’ calcrete and the comparatively soft ‘Loveday’ calcrete.

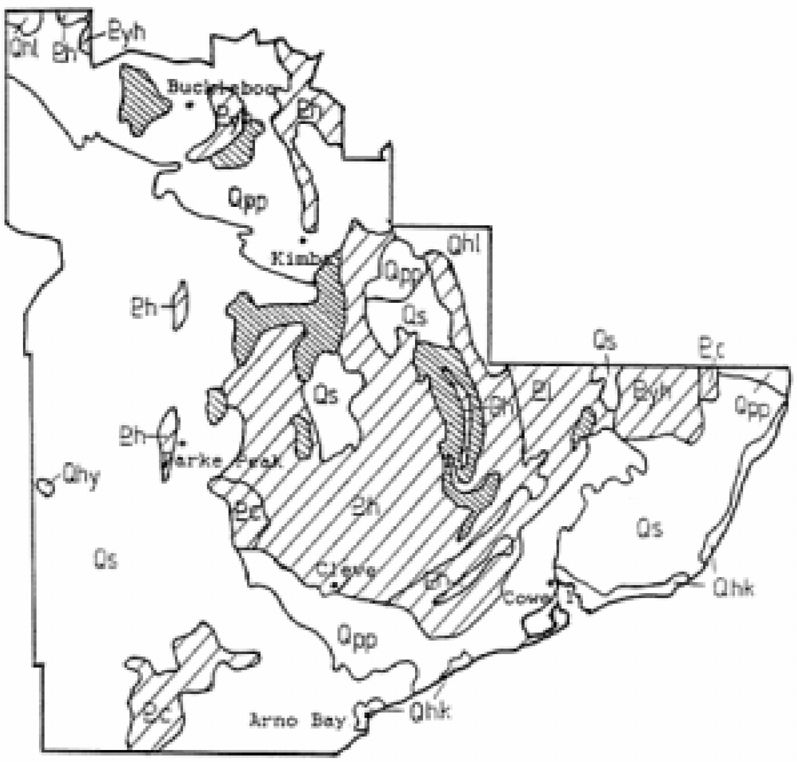
(2) Proterozoic age (600 million to 2300 million years old) formations of the Cleve hills, Darke Peak area and the Wharminda hills. These relatively old formations, dominated by the Lincoln Complex and Hutchison Group are mainly composed of granite, quartzite and schist. There has been considerable weathering and erosion of these rocks through time, producing alluvial and colluvial sediments in the valleys and piedmont slopes surrounding the hills.

(3) Archean age (greater than 2,300 million years old) ‘Sleaford Complex’ granitic gneiss occur associated with proterozoic formations, outcropping in some areas of the Cleve and Kimba hills.

The eastern coastline features low cliffs that expose the Quaternary deposits, and on the surface are recent (up to 10,000 years old). Coastal sand dunes and associated saline swamps. There are small areas of lake beds with gypsum in the far north-west and north-east (Lake Gilles) of the Board District.

In many areas there is evidence of weathering of the basement rocks that occurred in the Tertiary period (1 million to 70 million years old), resulting in ironstone 'buckshot' gravel in the surface soil.

Figure 6. Geology of Soil Conservation Board District



Key:

Quaternary age (0 – 1 million years old)

Qhk 'St Kilda' formation beach and estuarine sediments
Qhl 'Playa' salt lake deposits
Qhy 'Yamba' formation lake deposits and aeolian gypsite
Qs Fluviatile sediments and aeolian sands
Qpp Piedmont alluvium and colluvial sediments

Proterozoic age (600 – 2300 million years)

Pyh 'Lincoln Complex' granites
Pc 'Blue Range Bed' sandstones & conglomerates
Ph 'Hutchison Group' schists, granites & gneisses

Archean age (> 2300 million years old)

AP 'Sleaford Complex' granitic gneiss

Source: Geological Map of South Australia, S.A. Dept of Mines and Energy, 1982.

4.4 Soils

Soils in the Eastern Eyre Soil Conservation Board area are closely related to the geological type and age of parent materials. These can be summarised as:

(1) White siliceous (quartz) sands in parallel ridges ('Moornaba sand') or jumbled dunes ('Lowan sand') and sand spreads (eg 'Heggaton sands'); these are neutral to slightly alkaline pH, tend to be water repellent, and have low fertility and organic matter content' manganese deficiency sometimes occurs in susceptible crops. The 'Semaphore sands' that occur along the coast are highly susceptible to drift and are not suited to agricultural use.

(2) Whitish calcareous sands in Tooligie land system in the Hincks Conservation Park are highly alkaline and of low fertility level;

(3) Grey to reddish sandy loams to sandy clay loams that occur in the swales and flats in much of the dune-swale formations, and on flats to gently slopes ('Wiabuna soil'). These are mostly alkaline and contain calcrete rubble at varying depths, or with sheet calcrete outcropping at the surface. The 'Verran-Wharminda' soil has a neutral sandy surface with a clay, often sodic subsoil. These are moderately fertile soils.

(4) Reddish sandy loams to sandy clay loams ('Kimba soils') in the Kimba area; these are alkaline, comparatively fertile and productive soils, with high moisture storage capacity where the profiles are deep. Subsoil salt, sodium and boron that occur in some areas that may reduce yields.

(5) Sandy loam soils over clay that cover much of the southern Cleve hills ('Cleve soil', 'Nobby hills soil') and part of the surrounding piedmont slopes; these are often very shallow on higher slopes and crests of the hills, and are particularly susceptible to water erosion; these soils can be highly productive where there is sufficient depth for adequate moisture storage.

4.5 Land Systems

A 'Land System' is an area of land with a particular set of features that are distinguishable from surrounding land. These features are geology, topography, climate, soils and vegetation. The particular types of potential land degradation erosion, and limitations to land capability are closely related to individual land systems.

The Eastern Eyre Peninsula Soil Conservation District has been divided into 32 separate land systems, as presented in the Land System Map. An explanation of the symbols used to identify land systems are outlined in table 3.

Table 3: Summary of the land systems in the district

SYMBOL	EXPLANATION OF SYMBOLS	
(1) Land Systems with parallel siliceous sand dunes		
CST	Charleston	Rounded hills on granite with red sandy loam over sandy clay soils and parallel sandhills.
DIX	Dixon	Parallel sandhills with swales of sand over clay and calcareous sandy loam.
GYS	Glynn South	Undulating low hills on basement rock with red sandy loam soils and parallel sandhills.
HMB	Hambidge	Parallel sandhills with swales of calcareous sandy loams.
HNK	Hincks	Parallel sandhills with sand over clay and calcareous sandy loam in swales.
ISA	Isabella	Plains with sand over clay, calcareous sandy loam, parallel sandhills and calcrete outcrops.
KGW	Koongawa	Gently undulating rises with red and grey sandy clay loam soils and parallel sandhills.
LEH	Le Hunte	Plains with calcareous, highly calcareous and shallow stony sandy loams and parallel sandhills.
MTV	Mitchellville	Stony plains with shallow calcareous sandy loams, overlain by parallel sandhills.
PNE	Port Neill	Very gently sloping plains with sand over clay and calcareous sandy loam.
PNK	Pinkawillinie	Gently undulating plains with calcareous and non-calcareous sandy loams and parallel sandhills
VER	Verran	Plain with sand over clay, calcareous sandy loam and limited sandhills.
(2) Land Systems with jumbled siliceous sand dunes		
GYN	Glynn North	Jumbled siliceous sandhills with flats & rises of calcareous sandy loams and sand over clay.
HEG	Heggaton	Undulating rises and sandhills with sand over clay, deep sand and red sandy loam soils.
JAM	Jamieson	Undulating plains with sand over clays, jumbled sandhills, and flats and rises with red sandy loams.
MHI	Mount Hill	Undulating rises with jumbled sandhills, sand over clay and sandy loam over red clay.
PEE	Peella	Undulating land with calcareous loamy sands overlain by jumbled siliceous sandhills.
YLN	Yalanda	Undulating rises with sand over clay, and sandhills with deep sands.
(3) Land System with calcareous sand		
TOO	Tooligie	Calcrete plains and rises with jumbled calcareous and siliceous sandhills.
(4) Land Systems in the Kimba – Lock area		
BKB	Buckleboo	Very gently undulating plains and rises.
LOC	Lock	Very gently undulating plains and rises with calcareous sandy loams and some low sandhills.
MSL	Moseley	Plain with rubbly calcareous sandy loams to sandy clay loam soils.
(5) Land Systems in the Wharminda Hills area		
BLU	Blue Range	Low hills with gentle to moderate slopes and undulating summit surfaces.
BUT	Butler Tanks	Rises and low hills with sandy loam and sand over clay and calcrete outcrops.
(6) Land Systems on Wiabuna Formation carbonates and calcrete		
CBI	Corrobinnie	Depressions with salt lakes
MDG	Murdinga	Plain with moderately deep and shallow calcareous sandy loams, and limited sandhills
(7) Land Systems in the Cleve hills area		
CLV	Cleve	Very gently sloping outwash fans with deep calcareous and sandy loam over clay soils.
COW	Cowell	Very gently sloping plains with calcareous sandy loams, sandy loam over clay and shallow stony soils.
DAP	Darke Peak	Steep rocky hills flanked by gently sloping fans with deep sandy loam soils.
MGO	Mangalo	Low hills on basement rocks with red sandy loams over clay, and some sand over clay and stony soils.
YAB	Yabmana	Complex of low rounded hills and outwash fans with red sandy loam over clay soils.
YEL	Yedulknie	Undulating to steep rocky hills with shallow stony soils – 80% non-arable.

4.6 Drainage

In the Board area, creeks tend to flow only intermittently following heavy rains, with the exception of saline creeks that are driven by groundwater flows.

The northern Cleve hills area around Mangalo is the catchment for Salt Creek, which flows eastwards, then south, reaching Franklin Harbour in floods, but usually ending at Pondooma. There are several creeks that drain southwards from the Cleve-Cowell hills to the coast during floods. A large area west of the Cleve hills, extending north almost to Kimba forms a catchment for the Driver River, which drains to the coast south of Arno Bay.

The remainder of the Board area has only minor creeks and tributaries that usually flow only short distances.

A potential for flooding occurs in 'alluvial' land systems. Minor surface waterlogging sometimes occurs after heavy rains in areas of the southern and eastern piedmont slopes of the Cleve hills and in some valleys within the Cleve hills.

4.7 Vegetation

The native vegetation of the Soil Board area has been divided into eight 'vegetation formations'. These are based on the dominant vegetation growing on each of the 32 land systems. Vegetation formations are generally related to soil type.

The nine vegetation associations are:

(1) "*Low Open Forest*" (Mangrove)
(2) "*Low Woodland*" (Western Myall)
(3) "*Low Shrubland*" (Saltbush/Samphire)
(4) "*Low Open Forest*" (Sheoak)
(5) "*Open Scrub*" (Mallee/Tea Tree)
(6) "*Open Scrub*" (Mallee/Saltbush)
(7) "*Open Scrub*" (Mallee);
(8) "*Open Scrub*" (Mallee/Broombush);

Of these, the native vegetation in the District is dominated by the four *Open Scrub* associations.

The first and most widespread association is *Open Scrub* (Mallee/Broombush), which is characterised by Eucalyptus socialis (summer red mallee), E. incrassata (rigde fruited mallee) and E. leptophylla (narrow-leafed mallee), with a Melaleuca uncinata (broombush) understorey.

The second association is *Open Scrub* (Mallee) dominated by Eucalyptus socialis/E. pileata (white mallee)/E. gracilis (yorrel) and E. oleosa (red mallee). This association occurs mainly in the Kimba-Buckleboo area.

The third association of *Open Scrub* (Mallee/Saltbush) contains Eucalyptus porosa (mallee box)/E. gracilis/E. oleosa with an understorey of Atriplex vesicaria (bladder saltbush). This is most common on the piedmont slopes and lower slopes of the southern Cleve hills and much of the area north-east of Cowell.

The fourth, and least widespread *Open Scrub* association (Mallee/Tea Tree) occurs only in the far south west of the District, the Hincks Conservation Park and the adjacent Hundreds of Verran and Roberts. This association is characterised by Eucalyptus pileata/E. socialis/E. brachycalyx (gilja mallee) and has an understorey of Melaleuca lanceolata (dryland tea tree).

The skeletal soils of the southern Cleve hills and a small area in the ranges to the north west of Wharminda support a *Low Open Forest* association of sheoaks (Allocasuarina verticillata) with a varied understorey of Acacia species, native grasses and heath species. An unusual feature of this vegetation association is distinct scattered patches where sheoaks are totally absent, replaced by mallee/broombush species.

The coastal margins are dominated by a *Low Shrubland* (Chenopod) association of Atriplex cinerea (saltbush) and Spinifex species and along the sea front. Acacia longifolia *var. sophorae* (coastal wattle) and Melaleuca lanceolata (dryland tea tree) occur further inland.

Saline valleys eg. Driver River and Salt creek support a *Low Shrubland* of saltbush (Atriplex species) and samphire (Halosarcia species) with occasional patches of stunted red mallee.

In two small areas in the extreme northern section of the District, western myall (Acacia papryocarpa) grows on the higher ground adjacent to salt lakes.

Another association that is extremely restricted in its extent is *Low Open Forest* (Saltmarshes and Mangrove). It occurs only within the sheltered sections of Franklin Harbour and Arno Bay and is totally dominated by Avicennia marina (mangrove) with an understorey of samphire.

Coastal Saltmarshes are intertidal plant communities dominated by herbs and low shrubs and are present in low lying saline areas and estuaries. Saltmarshes are highly productive key habitats that support many other organisms. The plants of the saltmarsh act to filter nutrients from terrestrial water preventing them from entering the marine system. Threats to saltmarshes along this section of coast include sedimentation, reclamation, dumping of rubbish on public and private sections of land, off-road vehicles and invasion by weeds.

Mangroves are species adapted to the periodic inundation and salty conditions of the intertidal zone. They provide habitats and nurseries for many fish, birds and other wildlife.

A final formation which isn't included on the "vegetation formations" map is the Blue gum woodlands which occur predominantly in the valleys of the Cleve Hills and along creeklines on the adjacent plains. This formation is dominated by Eucalyptus petiolaris, and endemic to Eyre Peninsula, over Melaleuca neglecta (tea tree), Callistemon rugulosa (bottlebrush) and Juncus kraussii, often growing in association with Allocasuarina verticillata (drooping sheoak), Pittosporum phylliraeoides (native apricot) and Callitris preissii (native pine). They are considered of high conservation significance.

Native plant species of significance

There are 10 species of native vegetation with particular significance within the Eastern Eyre Peninsula District. These species may be either of Eyre Peninsula, South Australia or of national significance.

The following categories describe the conservation status ratings:

E = Endangered, rare and in danger of disappearing from the wild in the short term.
V = Vulnerable; rare and in danger of disappearing from the wild in the long term.
R = Rare; occurring infrequently, either locally abundant in a limited area or sparsely distributed over a wide area.
T = Threatened
K = Status uncertain; however it is considered likely to be either 'Rare', 'Vulnerable' or 'Endangered'.

The following list of plants are those which have significant conservation significance on either Eyre Peninsula or for South Australia.

Scientific Name	Common Name	SA Significance	EP Significance
Acacia cretacea	Chalky Wattle	E	E
Acacia enterocarpa	Jumping-jack Wattle	E	E
Acacia rhetinocarpa	Resin Wattle	V	V
Caladenia brumalis	Winter Spider-orchid	V	V
Limosella granitica	Granite Mudwort	V	V
Olearia pannosa ssp pannosa	Silver Daisy Bush	V	T
Prostanthera calycina	West Coast Mint bush	V	V
Pterostylis aff despectans	Lowly Greenhood	V	V
Swainsona pyrophila	Yellow Swainson-pea	R	R
Thysanotus nudicaulis		E	E

For further information on these species contact the Threatened Flora Project Officer at the Department of Environment and Heritage Office in Port Lincoln on 8688 3180

Photo: B. Sorenson

Acacia cretacea – Chalky Wattle, Endangered on Eyre Peninsula

5. LAND CAPABILITY CLASSES

Land capability refers to the land to support a particular land use and sustain that use in the long term. A land use is 'within' the capability of the land if it maintains or improves the condition of the land.

Land can be categorised into one of eight classes according to its capability for agricultural use. The capability of the land, and therefore the class into which it is placed depends on the nature of its physical characteristics or limitations.

Land in class **I** has no significant limitations to agricultural use while land in class **VIII** has no agricultural value. Between these extremes of very high to very low capability is a range of classes requiring progressively more intensive or stringent management to make the land use succeed and to minimise the risk of land degradation.

All classes of land <u>however</u> require appropriate management practices so that they are not degraded over time.

These land classes are described as follows:

ARABLE LAND:

Class I Land with no significant limitations which is suitable for all types of agricultural production on a permanent basis.
Class II Land with slight limitations, suitable for most types of agricultural production on a permanent basis provided that careful planning and simple modifications to standard practices are applied (eg. Stubble retention, reduced tillage).
Class III Land with moderate limitations, suitable for most types of agricultural production on a permanent basis, provided that very careful planning and intensive management practices are applied.

SEMI-ARABLE LAND

Class IV Semi-arable land not suitable for cultivated cropping on a regular basis.

NON-ARABLE LAND

Class V Land with severe limitations which is not capable of annual cropping but has the capacity for <u>improved</u> pastures.
Class VI Land not traversable with standard equipment due to steep slopes or excessive rockiness. The land is capable of supporting grazing of native or volunteer pastures.
Class VII Land with extreme limitations which requires protection by permanent vegetation.
Class VIII Land with no agricultural value, usually conservation land use, including exposed rock, bare salt pans and land permanently inundated.

There may be more than one limiting factor to land use within a particular area that determines land class. The following factors influence land capability classes in the Board areas, the symbols represented as a subscript after the land classes.

Factor (Land Quality)	Symbol
Sheet and rill (water) erosion potential	e
Wind erosion potential	a
Salinity	s
Rockiness	r
Soil moisture holding capacity	m
Soil structure (physical condition)	p
Soil surface condition	c
pH (alkalinity)	i
Soil nutrient fertility	n
Water repellence	u
Gullying/tunnelling	g
Proximity to water courses	q
Flooding potential	f
Recharge area for saline water table	y
Rainfall	x
Boron toxicity	t

Land which has been managed in a certain way for a period of time may result in the land changing from one class to another (eg severely water eroded). Also, new technology may result in a changing of land classes (eg no-till seeding techniques) and their management.

6. LAND USE

6.1 History of Land Use

Settlement 1853 – 1900

Cowell was first settled by sheep graziers in 1853, although closer settlement occurred after subdivision of land in 1878. Land west of Kimba was first occupied under pastoral lease in 1870, and the Kimba district became more closely settled when land was first subdivided in 1890. The first 8 Hundreds in the District surrounding Cowell were proclaimed in the period 1866 – 1890. Almost all of remaining Hundreds in the Board area were proclaimed by 1920.

Agricultural Phase 1900 – 1929

During this period, mallee scrub continued to be cleared for agriculture, and wheat yields began to improve with the use of phosphate fertiliser. The railway line from Port Lincoln to Kimba was completed in 1913 enabling transport of produce to the coast.

The practice of cropping wheat after wheat however soon led to serious weed competition with patchy crops due to nitrogen deficiency. By the 1920's, the practice of separating wheat crops with a long, cultivated 'fallow' to overcome weed problems and to conserve moisture was adopted. Multiple cultivations, aided by the development of tractors soon resulted in widespread drift and water erosion. Sand ridges continued to be cleared with little regard for drift potential. Wheat growing peaked before 1929, when a severe drought occurred and wheat prices declined.

Depression Years 1930 – 1945

With the depression, the population of Eyre Peninsula decreased by almost a quarter from 1933 to 1946. Wartime shortages of labour and finance for fertiliser and upkeep of fencing and machinery, together with rabbit plagues and droughts in 1943 – 1945 resulted in widespread soil erosion and reduced soil fertility.

A "Marginal Lands Bill" was passed by State Parliament in 1940 aimed at reducing degradation of lower rainfall land, largely along or north of Goyder's Line. This allowed an amalgamation of farms for sale into larger, more profitable holdings, which enabled farmers to widen cropping rotations and limit the area sown to crops each year.

During the period of 1900 – 1945 large areas of land were cleared and often poor quality land as landowners were encouraged to reduce rabbits and other vermin.

Rehabilitation Years – since 1945

Following the war, farm profitability and wool prices increased and the intensity of cereal cropping began to decrease.

The practice of fallowing was soon replaced by 'Ley' farming, where a 2 or 3 year medic based pasture provided a 'break' between crops. Increased superphosphate application and productive medic varieties greatly improved soil fertility. Crop yields also doubled from the 1930's to 1950. The spread of the Myxomatosis virus around 1950 greatly reduced competition for stockfeed and soil disturbance caused by rabbits.

Effective methods were developed for the stabilisation of sand drifts by early sowing of cereal rye with 2:1 super-ammonia, and control of rill and sheet erosion on sloping land by the construction of contour banks. The adoption of such practices was promoted in the District by the (then) Upper Eyre Peninsula Soil Conservation Board, formed in 1947.

6.2 Present Land Use

Current land use within the Eastern Eyre Peninsula Soil Conservation Board District is summarised in Table 4.

Table 4: Land Utilisation in Board District

LAND USE	**AREA**		**% AREA**
	(Km^2)	**(ha)**	
Uncleared native scrub	3,500	350,000	29
Scattered vegetation	300	30,000	2
Cleared land	8,000	800,000	68
Coastal dunes and backswamps	100	10,000	1
Mangrove swamps	5	500	<0.1
TOTAL	**11,905**	**1,190,500**	**100.0**

Almost 29% of land in the District is uncleared native vegetation. Of this, approximately 44% occurs in the following conservation parks: Hincks, Hambidge, Pinkawillinie, Munyaroo, Carrapee Hill, Sheoak Hill and Middlecamp. As at 1999, 35,850 hectares of land was registered under Heritage Agreement in the District.

Livestock (sheep) numbers, cereal cropping area and annual production in the Board area are given in Table 5.

The number of establishments in the Board area has decreased by 84 in the 9 years from 1979 to 1988 and 28 in the 9 years from 1988 to 1997. The area of cereal cropping has increased in this period to 340,260 hectares, while livestock (sheep) numbers have remained static.

The cereal crop production figures for 1988/89 in the Board area are an indication of a poor season over much of Eyre Peninsula compared to the relatively good season of 1979/80. Cereal yields in the Board area are influenced by the pattern of rainfall over the May-October period.

In recent years, there has been a trend towards more intensive cropping due to declining economic returns in farm production. As a result, greater attention needs to be paid to the management of crop diseases through rotation management.
In addition to increased cropping intensity, the use of low zinc-content high analysis fertilisers which have largely replaced traditional products, has contributed to an increase in the incidence of zinc deficiency in crops and pastures. The use of zinc-enriched fertiliser or zinc foliar sprays is required where deficiencies are identified.

Table 5: Selected Production Data

Livestock (sheep) Numbers

YEAR	EEP SOIL BOARD	TOTAL IN SOUTH AUSTRALIA	% OF SOUTH AUSTRALIA	TOTAL IN EYRE PENINSULA	% OF EYRE PENINSULA
1979/80	560,125	16,046,260	3.5	2,218,879	25.2
1981/82	616,632	16,708,863	3.7	2,358,388	26.1
1988/89	546,491	17,431,880	3.1	2,242,495	24.4
1996/97	580,524	13,106,006	4.4	2,081,374	27.9

Number of Establishments and Cereal Cropping Area (ha)

YEAR	EEP SOIL BOARD: NO. OF EST	CROPPING AREA (ha)	TOTAL CROPPING AREA IN SA (ha)	% OF SA	TOTAL CROPPING AREA ON EP (ha)	% OF EYRE PENINSULA
1979/80	593	299,111	2,536,849	11.8	992,366	30.1
***1981/82**	556	308,544	2,586,505	11.9	1,005,659	30.7
***1988/89**	509	509,688	2,512,160	20.3	1,073,576	47.3
1996/97	470	340,260	2,780,651	12.2	994,356	34.2

Cereal Crop Production (tonnes)

YEAR	EEP SOIL BOARD (t)	TOTAL IN SOUTH AUSTRALIA (t)	% 0F SOUTH AUSTRALIA	TOTAL IN EYRE PENINSULA (t)	% OF EYRE PENINSULA
1979/80	444,812	4,020,295	11.1	1,433,232	31.0
***1981/82**	303,300	3,019,692	10.0	953,641	31.8
***1988/89**	144,017	2,528,491	5.7	570,014	25.3
1996/97	499,098	5,018,578	9.9	1,497,906	33.3

* Poor seasons

Source: Australian Bureau of Statistics